tures on Histology, vol. i. fig. 41, 8vo, Lond. 1852), as he remarked to me when we examined them under a magnifying power of about 350 diameters; but the canaliculi of the corpuscles are not quite so distinct in the *Arbutus* as in the Pear.

As to their chemical composition, Dr. Davy kindly examined them at my request, and reports that "they consist chiefly of vegetable matter, and contain only a very small proportion of lime, with a trace of phosphate of lime."

Abstract of a Lecture by Prof. T. H. Huxley, F.R.S., *on Species and Races, and their Origin, delivered before the Members of the Royal Institution, on the Evening of Friday, February* 10, 1860.

The speaker opened his discourse by stating that its object was to place the fundamental propositions of Mr. Darwin's work 'On the Origin of Species by Natural Selection' in a clear light, and to consider whether, as the question at present stands, the evidence adduced in their favour is, or is not, conclusive.

After some preliminary remarks, in the course of which the speaker expressed his obligations for the liberality with which Mr. Darwin had allowed him to have access to a large portion of the MSS. of his forthcoming work, the phenomena of species in general were considered—the Horse being taken as an example of such species. The distinctions between this and other closely allied species, such as the Asses and Zebras, were considered, and they were sbown to be of two kinds, structural or morphological, and functional or physiological. Under the former head were ranged the callosities on the inner side of the fore and hind limbs of the Horse—its bushy tail, its peculiar larynx, its short ears, and broad hoofs; under the latter head, the fact that the offspring of the horse with any of the allied species is a hybrid, incapable of propagation with another mule, was particularly mentioned.

Leaving open the question whether the physiological distinction just mentioned is, or is not, a universal character of species, it is indubitable that it obtains between many species, and therefore has to be accounted for by any theory of their origin.

The species *Equus caballus*, thus separated from all others, is the centre round which a number of other remarkable phenomena are grouped. It is intimately allied in structure with three other members of the existing creation, the Hyrax, the Tapir, and the Rhinoceros; and less strait, though still definite, bonds of union connect it with every living thing. Going back in time, the Horse can be traced into the Pliocene formation, and perhaps it existed earlier still; but in the newer Miocene of Germany it is replaced by the *Hippotherium*, an animal very like a true *Equus*, but having the two rudimental toes in each foot developed, though small. Further back in time, in the Eocene rocks, neither *Equus* nor *Hippotherium* have been met with, nor *Rhinoceros*, *Tapirus*, nor *Hyrax*; but, instead of them, a singular animal the *Palæotherium*, which exhibits certain points of resemblance with each of the four existing genera, is found.

The speaker pointed out that these resemblances did not justify us in considering the *Palæotherium* as a more generalized type, any more than the resemblance of a father to his four sons justifies us in considering him as of a more generalized type than theirs.

The geographical distribution of the *Equidæ* was next considered; and the anomalies and difficulties it offers were pointed out; and lastly, the variations which horses offer in their feral and their domesticated condition were discussed.

The questions thus shown to be connected with the species Horse are offered by all species whatever; and the next point of the discourse was the consideration of the general character of the problem of the origin of species of which they form a part, and the necessary conditions of its solution.

So far as the logic of the matter goes, it was proved that this problem is of exactly the same character as multitudes of other physical problems, such as the origin of glaciers, or the origin of strata of marble; and a complete solution of it involves—1. The experimental determination of the conditions under which bodies having the characters of species are producible. 2. The proof that such conditions are actually operative in nature.

Any doctrine of the origin of species which satisfies these requirements must be regarded as a true theory of species; while any which does not, is, so far, defective, and must be regarded only as a hypothesis whose value is greater or less, according to its approximation to this standard.

It is Mr. Darwin's peculiar merit to have apprehended these logical necessities, and to have endeavoured to comply with them. The pigeons called Pouters, Tumblers, Fantails, &c., which the audience had an opportunity of examining, are, in his view, the result of so many long-continued experiments on the manufacture of species, and he considers that causes essentially similar to those which have given rise to these birds are operative in nature now, and have in past times been the agents in producing all the species we know. If neither of these positions can be upset, Mr. Darwin's must be regarded as a true theory of species, as well based as any other physical theory; they require, therefore, the most careful and searching criticism.

After pointing out the remarkable differences in structure and habit between the Carrier, Pouter, Fantail, Tumbler, and the wild *Columba livia*, the speaker expressed his entire agreement with Mr. Darwin's conclusion, that all the former domesticated breeds had arisen from the last-named wild stock; and on the following grounds—1. That all interbreed freely with one another. 2. That none of the domesticated breeds presents the slightest approximation to any wild species but *C. livia*, whose characteristic markings are at times exhibited by all. 3. That the known habits of the Indian variety of the Rock Pigeon (*C. intermedia*) render its domestication easily intelligible. 4. That existing varieties connect the extremest modifications of the domestic breeds by insensible links with *C. livia*. 5. That there is historical evidence of the divergence of existing breeds, *e.g.* the Tumbler, from forms less unlike *C. livia*.

The speaker then analyzed the process of selection by which the domesticated breeds had been produced from the wild Rock Pigeon, and he showed its possibility to depend upon laws which hold good for all species,—viz. 1. That every species tends to vary. 2. That variations are capable of hereditary transmission. The second law is well understood; but the speaker adverted to the miscomprehension which appears to prevail regarding the first, and showed that the variation of a species is by no means an adaptation to conditions in the sense in which that phrase is commonly used. Pigeon fanciers, in fact, subject their pigeons to a complete uniformity of conditions; but while the similarly used feet, legs, skull, sacral vertebræ, tail-feathers, oil-gland, and crop undergo the most extraordinary modifications, on the other hand, the wings, whose use is hardly ever permitted to the choice breeds, have hitherto shown no sign of diminution. Man has not as yet been able to determine a variation; he only favours those which arise spontaneously, *i.e.* are determined by unknown conditions.

It must be admitted that, by selection, a species may be made to give rise experimentally to excessively different modifications; and the next question is, do causes adequate to exert selection exist in nature? On this point, the speaker referred his audience to Mr. Darwin's chapter on the struggle for existence, as affording ample satisfactory proof that such adequate natural causes do exist.

There can be no doubt that just as man cherishes the varieties he wishes to preserve, and destroys those he does not care about, so Nature (even if we consider the physical world as a mere mechanism) must tend to cherish those varieties which are better fitted to work harmoniously with the conditions she offers, and to destroy the rest.

There seems to be no doubt, then, that modifications equivalent in extent to the four breeds of pigeons might be developed from a species by natural causes; and therefore, if it can be shown that these breeds have all the characters which are ever found in species, Mr. Darwin's case would be complete. Unfortunately, however, there is as yet no *proof* that, by selection, modifications having the physiological character of species (*i.e.* whose offspring are incapable of propagation, *inter se*) have ever been produced from a common stock.

No doubt the numerous indirect arguments brought forward by Mr. Darwin to weaken the force of this objection are of great weight; no doubt it cannot be proved that all species give rise to hybrids infertile *inter se*; no doubt (so far as the speaker's private conviction went) a well-conducted series of experiments very probably would yield us derivatives from a common stock, whose offspring should be infertile *inter se*; but we must deal with facts as they stand, and at present it must be admitted that Mr. Darwin's theory does not account for all the phenomena exhibited by species: and, so far, falls short of being a perfectly satisfactory theory.

Nevertheless, the speaker expressed his sense of the extremely high value to be attached to Mr. Darwin's hypothesis, and avowed his own conviction that the following it out must ultimately lead us to the detection of the laws which have governed the origin of species.

Mr. Darwin's Theory of Development. By J. O. Westwood.

The observation relative to the Swedish Turnip to which I alluded in my note on this subject occurs in page 997 of last year's 'Gardeners' Chronicle,' and is to the effect that the discussion at the Central Farmers' Club, on Monday, 5th December, turned upon the need of finding a substitute for that vegetable, which was rapidly deteriorating in the hands of the farmer in spite of the best efforts both of agriculturists and scientific men. With reference to Mr. Darwin's note on this subject (*ante*, p. 49), I apprehend, in the absence of details, that this is not a question as to the permanence of a cross-bred production, but one of reversion, in which it is found impossible to maintain the status of a species which has been ennobled (to use a term which has lately been adopted for these modified high-bred specimens, and which we may expect to see applied with equal propriety to the fat pigs exhibited at Christmas which can neither see nor walk). These latter, like the Swedish Turnips, have been brought by man out of their natural condition; they are, in fact, monsters, and Nature will get rid of them and revert to the old true type of the species. Of varieties of distinct species produced in a state of nature, even when carried beyond individual variations (which have been termed sub-species or geographical varieties), I believe also that Nature constantly endeavours to get rid of them in the same manner, although a persistence of the predisposing causes may, even for a long time, render the variety apparently permanent. I cited the case of the Ibis as an instance showing that a species has remained permanent during the whole historic period; and I think that we are thereby authorized in supposing that if that bird were reduced to the condition of a single pair (as its first creation), the progeny of that pair would in 3000 more years be as true to the character of the species as the present individuals are. As to the hive-bee, I intended to allude more especially to the case where a single hive might become the founder of an extensive apiary far removed from any other, the different hives being of course tenanted by the progeny of the first stock. Extensive bee-keepers do not find it necessary to import hives from a distance to keep up their establishments; and thus the species would keep true, immaterial whether the queens paired with their own subjects or with those of adjacent hives, all having descended from the same single stock-hive. The Egyptian records furnish us with another instance which we find to be in complete opposition to Mr. Darwin's theory. We there see the African ostrich, one of the most extreme types of the class of birds, faithfully represented. According to Mr. Darwin's theory, it is mainly for the welfare both of the species and individual that modifications take place and new forms are developed. Now, there can be no doubt that it would have been beneficial to this bird, both specifically and individually, if its coveted plumes could have been shortened and its wings lengthened, so as the better to escape from its pursuers. Moreover, as every one who saw the tame ostriches in the circus at Kensington during the Great Exhibition of 1851 will recollect, when driven to their fullest speed

they stretch out their short stumps of wings in order to assist in their attempts to escape. But all their efforts to acquire by such means the additional power of flight have been unavailing, and the type of the species remains as it was in this respect 3000 years ago. And in the case of other analogous species of birds, such as the Dinornis and the Dodo, we know that the actual destruction of the species has taken place, whilst that of the Kivi of New Zealand is equally certain in a very short time. I purposely avoid referring to geological evidences, believing that—1st, if the permanence of a species can be proved for such a length of time as 3000 years; 2ndly, if it be admitted that varieties exhibit a tendency to revert to the original type; and 3rdly, if cases can be shown in which modifications beneficial to a species have not taken place in wild animals, even when the creature has made efforts in that direction, we are in each of these cases furnished with an answer to Mr. Darwin's theory. As regards the second of these points, it seems inevitable that a theory which supposes the principle of development to be inherent in the works of the creation cannot be maintained if it be admitted that the antagonistic principle of reversion be also inherent in individuals. Mr. Darwin builds his theory that species are only intensified varieties, and that generic groups are only intensified species, mainly on the modifications which man has effected in domestic animals. For his theory, however, to work, it is necessary to suppose that the modified individuals possess such powers of discrimination as well as of exclusiveness as not to allow of their intermingling with their less favoured brethren, whereby they would keep their improvements to themselves. Thus, supposing the large and small common white Cabbage-butterflies to be modifications of one species, we must allow to them (as they never pair together, although frequenting the same garden and feeding on the same cabbage) a power of selection for breeding purposes which the improved breeds of domestic animals do not possess. The terrier and spaniel, or the pouter and tumbler pigeons will, under similar circumstances, breed together, although they apparently differ much more from each other than these two species of butterflies. It will at once be seen that the idea of such a power of selection becomes more and more untenable the nearer we ascend to the supposed origin of the modification.—*Gardeners' Chronicle*, Feb. 11, 1860.

Mr. Darwin on the Origin of Species. By W. H. Harvey, M.D.

In a recent number of the 'Gardeners' Chronicle' you figure a monstrous many-headed Cauliflower; and, in making some editorial remarks upon it, you suggest that it possibly throws some light upon the way in which species, according to Mr. Darwin's theory, originate in Nature. I am not quite sure that, as respects this particular Cauliflower, Mr. Darwin would agree with you, for it hardly comes within his principle, which denies to natural selection any power to act, unless the variation acted on be "favourable to the variety," in battling with its neighbours in "the struggle for life." Now, though the many heads may be very advantageous to the cook or the market gardener, it is doubtful whether, in a crowded society,